

## SUCTION HEAD OF VACUUM CLEANER WITH POWER BRUSH

### BACKGROUND OF THE INVENTION

#### 5 1. Field of the Invention

The present invention relates to a suction head of a vacuum cleaner and particularly, to a suction head of a vacuum cleaner with ~~a power brush rotary abutted on the cleaning object~~ that rotatively contacts with an object to be  
10 cleaned to ~~separate a foreign material~~ dislodge and suck up debris from the cleaning object and ~~suck the foreign material~~.

#### 2. Description of the Background Art

15 Generally, a vacuum cleaner is a cleaning instrument for collecting and cleaning ~~foreign materials~~ absorbing debris such as dusts and the like existing on cleaning ~~an~~ objects object to be cleaned, such as a carpet using a by a strong suction force generated by operation of a fan motor assembly.

Among the conventional vacuum cleaners, a vacuum cleaner having a  
20 power brush which is also called as an agitator in the ~~a~~ suction head to improve cleaning performance is known. ~~for removing foreign materials~~ The power brush removes debris from the cleaning object by rotatively brushing or agitating the object to be cleaned to di lodge debris therefrom. ~~more easily by separating foreign materials being rotary abutted on the cleaning object, thus to~~  
25 ~~improve cleaning performance is known.~~

As shown in Figure 1, the conv ntional vacuum cleaner having the power brush includes a cleaner body 1 having a fan motor assembly for generating a suction force to suck foreign materials debris such as dusts and the like existing on the cleaning object to be cleaned, a connecting tube 5 which is a passage  
 5 ~~lengthened connected to~~ extending from the cleaner body 1, ~~for sucking the foreign materials~~ receiving debris, and a suction head 10 connected to the end of the connecting tube 5 for sucking foreign materials in debris under the condition that it is ~~abutted to the cleaning object in the vicinity to the cleaning object.~~ upon contacting with or being in proximity to the object to be cleaned.

10 Particularly, in the suction head 10, a power brush 20 is installed for separating foreign materials dislodging or agitating debris existing on the cleaning object to be cleaned is installed.

The structure of the suction head having the power brush will be described with reference to Figure 2.

15 The suction head 10 includes a head case 11 connected to the connecting tube 5 shown in Figure 1 and having a suction hole <sup>15</sup> ~~in the lower surface thereof~~ for sucking foreign materials debris ~~on the lower surface at the same time~~, a power brush 20 having a part protruded to outside partially protruding through the suction hole 15 in of the head case 11, being ~~rotary abutted to the cleaning~~  
 20 ~~object~~ and rotatively contacting the object to be cleaned, a rotation shaft 25 rotatably installed ~~rotatably~~ in the head case 11, for supporting the power brush 20, and an electric motor 30 fixed in with the head case 11, for ~~rotary operating~~ rotating and driving the power brush 20 by ~~rotating~~ via the rotation shaft 25.

Here, the power brush 20 has a cylindrical shape and the rotation shaft 30  
 25 25 is fixed rotatably connected to the center portion of the both sides of the

power brush 20. On the outer circumferential surface of the power brush 20, a brush bristles 22 are positioned in the a spiral direction ~~to the direction of~~ along the rotation shaft 25 to be abutted to the surface of the cleaning object is installed allow contacting and brushing of an object to be cleaned.

5 The electric motor 30 is fixed in a parallel manner to the power brush 20 and the rotation force shaft 25 ~~in the head case 11~~ and respective pulleys 33 and 34 are respectively positioned on the shaft 31 of the electric motor 30 and the rotation shaft 25. The pulleys 33 and 34 are mutually connected ~~to~~ by the belt 35 ~~mutually,~~ and accordingly, the driving force generated ~~in~~ by the electric motor 30  
10 can be transmitted to the power brush 20.

In the vacuum cleaner having the conventional power brush with the above described structure, when the ~~pan~~ fan motor assembly in the cleaner body 1 is operated, a suction force is generated in the head case 11 of the suction head 10, and ~~at~~ At this time, ~~foreign materials~~ debris such as dusts and the like existing  
15 on the cleaning object to be cleaned are sucked through the suction hole 15 of the head case 11.

When a electric power is supplied to the electric motor 30 in the suction head 10, the power brush 20 rotates and ~~separates foreign materials~~ dislodges debris from the object to be cleaned as it is ~~rotary abutted to~~ contacts with  
20 and brushes the surface of the cleaning object thereof. The separated foreign materials ~~are~~ dislodged debris is sucked through the suction hole 15 by the suction force generated in the cleaner body 1.

Th suction head of the vacuum cleaner having the conventional power brush has a ~~problem~~ problems in that additional space is required in the  
25 suction head 10 for installing th lectric motor 30 therein and the size of the

suction head 10 ~~becomes relatively larger~~ is undesirably large since because the electric motor 30 is installed ~~outside~~ externally from the power brush 20 to ~~rotate the power brush 20~~ provide rotation thereof and ~~additional space for installing the electric motor 30 in the suction head 10.~~

5 Also, the suction head of the vacuum cleaner having the conventional power brush also has a problem in that the belt 35 which transfers the driving force of the electric motor 30 to the power brush can be loosened in case of using the cleaner for a long period since the suction head is formed to transmit the driving force of the electric motor 30 to the power brush 20 by the belt 35 become  
10 loose after prolonged use and the rotary operation of the power brush 20 is not smoothly progressed, thus ~~to lowering~~ vacuum cleaning efficiency is lowered.

Particularly, the suction head of the vacuum cleaner having the conventional power brush also has a problem in that the foreign materials debris on the cleaning object to be cleaned are not easily removed since because the  
15 power brush is ~~formed to separate the foreign materials, being abutted to the cleaning object~~ contacts or brushes the object to be cleaned only in the direction that the power brush rotates, thus ~~to have a limit in improving~~ the vacuum cleaning performance of the cleaner operation is limited.

## 20 SUMMARY OF THE INVENTION

Therefore, the present invention is was developed to solve at least the above-identified problems of the conventional art and provides by providing a suction head of a vacuum cleaner with a power brush capable of performing  
25 achieving a more compact design reducing the size of the with minimum suction

head size by installing a motor and the like which provides a driving force to the power brush in inside the power brush structure itself.

Also, another object the present invention is to provide a suction head of a vacuum cleaner with a power brush capable of improving the performance of  
 5 ~~separating foreign materials~~ dislodging or removing debris from ~~a cleaning object~~  
an object to be cleaned by forming a structure where the power brush can  
simultaneously perform rotary and linear movements ~~at the same time~~, thus to  
 improve cleaning performance vacuuming operation.

To achieve these and other advantages and in accordance with the  
 10 purpose of the present invention, as embodied and broadly described herein,  
 there is provided a suction head of a vacuum cleaner with a power brush,  
 including a head case connected with to a cleaner body by via a connecting tube  
and having a suction hole ~~on~~ in a lower surface thereof, a power brush positioned  
 in the head case and ~~protruded toward the outside of~~ externally protruding from  
 15 the head case through the suction hole ~~thus to be abutted to a cleaning object~~  
allowing contact with the object to be cleaned, a supporting means fixed in the  
 head case, for supporting the power brush to ~~be capable of performing~~ allow  
 rotary and linear movements thereof, a rotary operating means installed between  
 the supporting means and the power brush in within the power brush itself, for  
 20 rotary rotatively operating the power brush, and a linear operating means  
 installed between the supporting means and the power brush in within the power  
 brush itself, for moving horizontally reciprocating the power brush linearly  
along the supporting member.

The power brush is can be formed to have ~~in the~~ a cylindrical shape  
 25 shaped body and ~~a brush is abutted to the cleaning object on the outer~~

circumferential surface and the brush is having a plurality of bristles arranged in a spiral shape on the circumferential surface of the power brush thereof.

The supporting means preferably includes a supporting shaft having both ends fixed on the inner walls of the head case under the condition that such that the supporting means protrudes from the power brush, a linear moving guide means positioned between the supporting shaft and the power brush, for guiding the power brush to move linearly along the supporting shaft, and a bearing installed between the linear moving guiding means and the power brush, for facilitating the rotating rotation of the power brush.

The linear moving guide means is preferably a guide bush having a cylindrical shape and fixed with the supporting shaft, due to having a cylindrical shape and combined coupling with an inner race face of the bearing in the a serration structure to allow mutually lock each other mutual inter-locking thereof in the rotary direction.

The guide bush has a stopper for restricting the linear movement of the power brush at the its both end portions, and the guide bush has a hole where allowing an electric cable passes to pass therethrough so that a electric power source can be supplied to the rotary operating means and the linear operating means.

The rotary operating means is preferably a rotary type motor comprising including a stator fixed to the supporting means and a rotor fixed on the inner circumferential surface of the power brush.

The linear operating means preferably includes a solenoid coil fixed to the supporting means, for generating lectromagnetic flux, a moving core fixed to the inner circumferential surface of the power brush, for generating a linear

moving force by the flux generated by the solenoid coil, and an elastic means supported in the head case, for generating an ~~exposed~~ opposing force to oppose a force generated between the solenoid coil and the moving core.

The elastic means is preferably installed between the both side surfaces  
5 of the power brush and the both inner wall surfaces of the head case, respectively,  
and provides an elastic force so that the power brush performs linear ~~fluctuating~~  
vibrating movement in the longitudinal direction.

Also, the suction head of a vacuum cleaner with a power brush includes a  
head case connected with to a cleaner body by via a connecting tube and having  
10 a suction hole ~~on~~ in a lower surface thereof, a power brush positioned in the head  
case and ~~protruded toward the outside of~~ protruding externally from the head  
case through the suction hole ~~thus to be abutted to a cleaning object~~ to allow  
contact with and brushing of an object to be cleaned, a supporting means  
fixed in the head case, for supporting the power brush to be capable of performing  
15 a rotary movement allow rotation thereof, and a rotary operating means installed  
between the supporting means and power brush ~~in the power brush~~, for rotary  
operating rotating the power brush.

Also, the suction head of a vacuum cleaner with a power brush includes a  
head case connected with to a cleaner body by via a connecting tube and having  
20 a suction hole ~~on~~ in a lower surface thereof, a power brush positioned in the head  
case and ~~protruded toward the outside of~~ protruding externally from the head  
case through the suction hole to ~~thus to be abutted to a cleaning object~~ contact  
and brush the object to be cleaned, a supporting means fixed in the head case,  
for supporting the power brush to be capable of performing linear movements, and  
25 a linear operating means installed between the supporting means and power

brush ~~in the power brush~~, for moving the power brush linearly.

As described above, the present invention has advantages in that the size of the suction head can be reduced and cleaning performance can be improved by improving ~~foreign material separating function from the cleaning object~~ the operation of dislodging debris from the object to be cleaned.

The foregoing and other, features, aspects and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

## 10 BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

Figure 1 ~~is showing~~ shows a conventional vacuum cleaner;

Figure 2 is a cross-sectional view taken along section line A-A of Figure 1 ~~and a horizontal sectional view showing a suction head of a~~ the vacuum cleaner with a conventional power brush;

Figure 3 is a side view showing a vacuum cleaner with a power brush in accordance with the present invention;

Figure 4 is a cross-sectional view taken along section line B-B of Figure 3 ~~and a horizontal sectional view showing a suction head of a~~ the vacuum cleaner with a power brush in accordance with the present invention;



Figure 5A is a detail view showing "~~C~~"-portion "C" of Figure 4; and

Figure 5B is a cross-sectional view taken along section line D-D of Figure 5A.

## 5 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

~~The number~~ A plurality of embodiments ~~of for~~ a suction head of a  
10 vacuum cleaner with a power brush in accordance with the present invention can  
~~be plural~~ are possible and hereinafter, the most desirable embodiment will be  
described.

Figure 3 is a side view showing a vacuum cleaner with a power brush in  
accordance with the present invention and Figure 4 is a cross-sectional view taken  
15 along section line B-B of Figure 3 ~~and a horizontal sectional view showing a~~  
suction head of a the vacuum cleaner with a power brush in accordance with the  
present invention.

With reference to Figure 3, the vacuum cleaner includes a cleaner body  
50 having a fan motor assembly for generating suction force and a collecting room  
20 for collecting foreign material debris, a collecting connecting tube 55 lengthened  
extending from the cleaner body 50, which is a passage where foreign materials  
are sucked for suctioned debris, and a suction head 60 positioned near from the  
cleaning object at the end of the connecting tube 55, for sucking foreign materials  
absorbing debris such as dusts and the like from the object to be cleaned.

25 Here, in the suction head 60, a power brush 70 is installed for separating

the foreign materials enabling debris from the cleaning object, to be cleaned by rotatably brushing the object to be cleaned. being rotary abutted to the cleaning object.

With reference to Figure 4, the suction head 60 includes a head case 61  
 5 connected with to the cleaner body 50 through via the connecting tube 55, a supporting shaft 65 ~~lengthened-installed~~ installed and extending in the longitudinal direction of the head case <sup>61</sup> in the head case 61, the power brush 70 combined with the supporting shaft <sup>65</sup> ~~to be moved~~ relatively movable in the ~~rectilinear~~ linear direction of ~~and in~~ the rotational direction to the supporting shaft  
 10 65, a rotary operating device 80 installed in within the power brush 70, for rotary rotating and operating the power brush 70, and a linear operating device 90 installed in the power brush 70, for moving the power brush 70 in the shaft direction of the supporting shaft 65.

Here, ~~on~~ in the lower surface of the head case 61, a suction hole 62 is  
 15 ~~lengthened-formed~~ formed (on the drawing) in the horizontal direction (as shown in Fig.4) to suck fluid air and foreign materials from the cleaning object debris from an object to be cleaned.

The supporting shaft 65 has both end portions fixed ~~on~~ to the inner walls of the both sides of the head case 61 and is positioned in parallel to the  
 20 longitudinal direction of the suction hole 62.

The power brush 70 includes a body part 71 having a cylindrical shape of the center with a central hole and a brush part 73 installed in the a spiral shape configuration on the outer circumferential surface of the body part 71. On the both side surfaces walls of the body part 71, each holes 74A 71a that for  
 25 receiving the supporting shaft 65 ~~penetrates is~~ are formed.

The rotary operating device 80 includes a stator 81 ~~combined~~ attached with the supporting shaft 65 as a single body ~~in the methods such as~~ by press fitting ~~and the like~~ or other attaching methods and a rotor 85 fixed on the inner circumferential surface of the body part 71 of the power brush 70 to ~~have a certain gap in the outer circumferential direction of the stator 81~~ face the stator 81 and having a certain gap therebetween, the body part 71 being rotary operated rotated by the interaction with between the rotor 85 the stator 81.

Such rotary operating device 80 has the same or similar structure with the conventional that of common rotary motors.

The linear operating device 90 includes a solenoid coil 91 wound around a portion of the supporting shaft 65, for generating electromagnetic flux, a moving core 95 ~~combined~~ attached with the body part 71 of the power brush 70 to be movable as a singly single body, for forming a magnetic path where the flux passes around the solenoid coil 91, and springs 96 and 97 supported on the inner walls of the both sides of the head case 61, for supplying providing an elastic force so that the power brush 70 ~~performs continuous~~ brush 70 performs continuous ~~horizontal direction~~ can reciprocate in the horizontal direction along the shaft 65 when the power brush is linearly operated.

Here, the solenoid coil 91 is wound around ~~the~~ a bobbin 93 fixed on the supporting shaft 65 and preferably positioned at the center part of the moving core 95. The moving core 95 has a cylindrical structure being fixed in the power brush and generates a linear driving force due to the difference of magnetic resistance by the magnetic flux generated at the solenoid coil 91.

The springs 96 and 97 are composed of ~~conventional~~ common coil springs, and in the embodiment of the present invention, the springs 96 and 97

are installed at both sides of the power brush 70. However, ~~at need,~~ the springs 96 and 97 can be installed at just one side so that the force opposed to the ~~rectilinear~~ linear moving force generated by the solenoid coil 91 and moving core 95, namely the force to move the power brush to the original position is supplied.

5        The rotary operating device 80 and linear operating device 90 are respectively installed ~~in parallel to the both side positions of the supporting shaft~~ 65 inside the power brush 70 ~~respectively,~~ and generate the driving force to make the power brush 70 ~~to~~ perform rotary and linear movements.

To enable rotary and linear movements of the power brush 70 around the  
10 supporting shaft 65 by the rotary operating device 80 and linear operating device 90, a moving supporting means for enabling rotary and linear movements of the power brush 70 is installed between the supporting shaft 65 and the power brush 70.

Figure 5A is a detail view showing "C" portion "C" of Figure 4, and Figure  
15 5B is a cross-sectional view taken along section line D-D of Figure 5A. With reference to Figures 5A and 5B, the moving supporting means is described.

The moving supporting means includes a guide bush 75 formed in a cylindrical shape being fixed around the supporting shaft 65, and a bearing 77 is being locked with the guide bush 75 in the rotary direction under the condition that  
20 it is installed in the hole ~~74A~~ 71a of the power brush 70 being combined with the guide bush 75 by the a serration method so that it can perform linear movements relatively.

The guide bush 75 is fixed on the supporting shaft 65 by the spline combining method, and has guide teeth 75A 75a which are composed of  
25 protrusions and grooves ~~lengthened-formed~~ extendingly form d in the shaft

direction so that the bearing 77 is combined with the guide teeth 75a formed on the circumferential surface ~~is formed~~ of the guide bush 75. At the both end parts of the guide bush 75, a stopper ~~77B~~ 75b is formed for determining the linear moving area stroke of the power brush 70 by restricting the movement of the bearing not to be ~~seceded~~ exceeded.

At the guide bush <sup>75</sup>, the stator <sup>91</sup> [80] of the rotary operating device 80 and a cable hole ~~75G~~ 75c to supply a power source to the solenoid coil 91 of the linear operating device 90 are formed.

The bearing 77 can be composed of a conventionally used ball bearing or roller bearing, and in the present embodiment, the ball bearing is applied.

The ball bearing includes an inner race ~~77A~~ 77a combined with the guide bush 75 and, an outer race ~~77B~~ 77b fixed in the hole ~~71A~~ 71a of the power brush 70, and a balls ~~77C~~ 77c installed between the inner race 77a and the outer race 77b. Particularly, on the inner circumferential surface of the inner race ~~77A~~ 77a, a combining engaging teeth ~~77A'~~ 77a' combined are engaged with the guide teeth ~~75A~~ 75a of the guide bush 75 by the a serration method, ~~which is same as like~~ the guide teeth ~~75A~~ 75a of the guide bush 75 are formed.

The operation of the suction head having the power brush in accordance with the present invention with the above structure will be described as follows.

When the fan motor assembly of the cleaner body 50 in Figure 3 is operated, a suction force is generated in the head case 61 and ~~foreign materials~~ debris such as dusts and the like are sucked together with the air ~~in the vicinity from outside~~ through the suction hole 62.

At this time, when a electric power is supplied to the stator 81 of the rotary operating device 80, the rotor 85 rotates around the supporting shaft 65 as

a single body with the power brush 70 and the brush part 73 of the power brush 70 is rotary abutted to the cleaning object contacted with the object to be cleaned.

Also, when the electric power is applied to the solenoid coil 91 of the linear operating device 90, flux is generated from the solenoid coil 91, a cable hole 75C where the flux passes the inner portion of the solenoid coil 91 and the moving core 95, and then returns to the solenoid coil 91 is formed.

At this time, the moving core 95 and power brush 70 linearly moves along the supporting shaft 65 to the direction that magnetic resistance is lowered among the passages of the flux, and the springs 96 and 97 respectively store up compressive and tensile elastic force.

Later, when the electric power supplied to the solenoid coil is cut off, the power brush 70 is returned to the initial its original position by due to the elastic force of the compressive compression and tensile tension springs 96 and 97. When the electric power supplied to the solenoid coil 91 is continuously repeatedly turned on and off, the power brush 70 repeats its linear reciprocating movement along the supporting shaft 65.

Therefore, the rotary operating device 80 and linear operating device 90 are operated at the same time, the power brush 70 rotates and simultaneously performs reciprocating movement in the horizontal direction. Therefore, foreign materials on the cleaning object can be certainly removed the dislodging of debris from an object to be cleaned is improved.

Namely, conventionally, the power brush removed foreign materials dislodged debris by moving in a rotary direction, that is, moving in just in one direction being abutted to the cleaning object when contacting and brushing the object to be cleaned. On the other hand, in accordance with the present

invention, the power brush 70 ~~removes the foreign materials~~ **dislodges debris** **from an object to be cleaned by** moving in a number of **more than one** directions such as **in the** rotary and horizontal directions and the like, being ~~abutted to the cleaning object~~ **while contacting and brushing the object to be**  
5 **cleaned**. Accordingly, the foreign materials ~~on the cleaning object~~ **debris on the** **object to be cleaned** can be efficiently removed and sucked.

Therefore, the present invention can improve cleaning performance of the cleaner by improving foreign material **the debris** removing function of the power brush 70.

10 ~~On the other hand~~ **Also**, in the present invention, **the** size of the suction head 61 can be reduced ~~comparing~~ **compared** with the conventional suction head having an additional operating device outside the power brush, by installing the rotary operating device 80 ~~for rotary operating the power brush 70 in~~ **within** the power brush 70 **itself**.

15 The suction head having the power brush in accordance with the present invention can improve the cleaning performance by improving foreign material **the debris** removing function since the power brush performs rotary and linear movements simultaneously, and the brush is ~~formed to be~~ **can perform** rotary and sliding ~~abutted to the surface of the cleaning object~~ **movements while contacting**  
20 **and brushing the object to be cleaned**.

Also, the suction head having the power brush in accordance with the present invention enables a compact composition **structure** by reducing the size of the head case since the rotary and linear operating devices are installed in **within** the power brush.

25 As the present invention may be embodied in several forms without

departing from the spirit or essential characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, 5 and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalence of such metes and bounds are therefore intended to be embraced by the appended claims.